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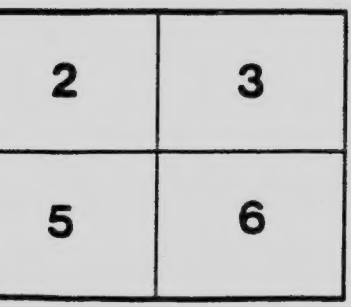

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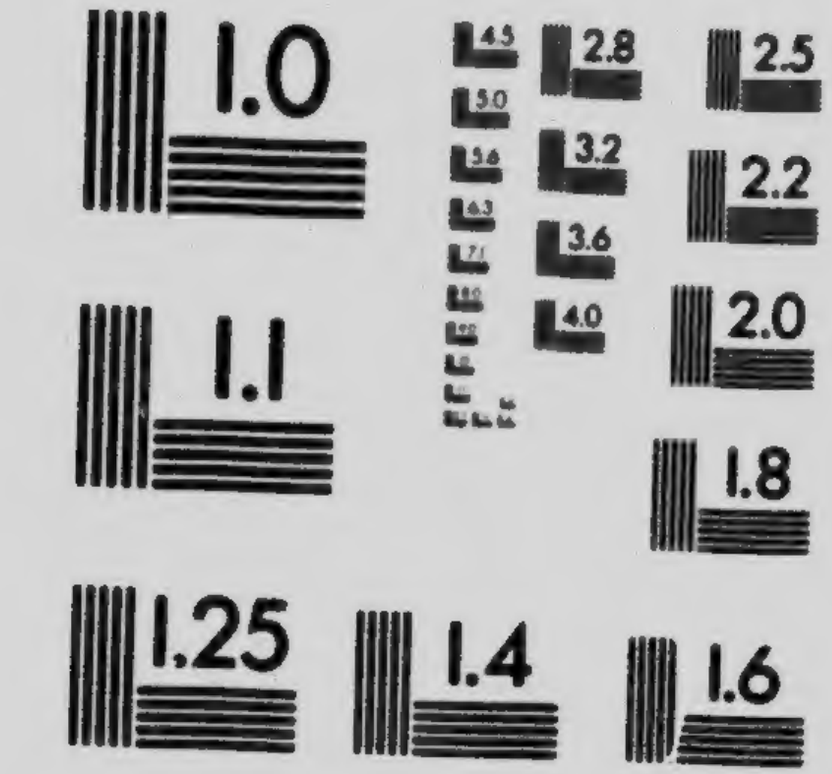

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REPORT

OF THE

CANADIAN ARCTIC EXPEDITION 1913-18

VOLUME VI: FISHES AND TUNICATES

PART B: ASCIDIACEA

By A. G. HUNTSMAN

SOUTHERN PARTY—1913-16

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OTTAWA
F. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1922

Issued Nov. 29, 1922.

Report of the Canadian Arctic Expedition, 1913-18.

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SOUTHERN PARTY—1913-16

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1922

Issued Nov. 29, 1922.

Arctic Ascidians.

By A. G. Huntsman

Biologist to the Biological Board of Canada

The importance of the Ascidian material collected by Mr. Frits Johansen of the Southern Party of the Canadian Arctic Expedition lies in the fact that it was largely procured from a region whose Ascidian fauna was almost entirely unknown, namely the western Canadian arctic and the arctic coast of Alaska. The records that this material affords assist in demonstrating the actual circumpolarity of a number of species.

By courtesy of the United States National Museum it has been possible to include in this report the results of the study of several small lots of Ascidians in the Museum's collection and hitherto unrecorded. In addition there is included a single record from arctic material of the Canadian Fisheries Museum.

The data for the stations of the Canadian Arctic Expedition at which Ascidians were obtained by Mr. Johansen, as well as the names of the species obtained at each place, are as follows:—

Station 20 *b* and *c*. Grantley harbour, Alaska, 2-3 fathoms, sandy mud, July 30, 1913.
Rhizomolgula globularis.

Station 20 *d*. Grantley harbour, Alaska, beach, July 31, 1913.
Rhizomolgula globularis.

Station 21, *d*, *e*, and *g*. East of Cape Lisburne, Alaska (68° 48′ N. lat., 165° 10′ W. long.), plankton tow, in surface, August 16, 1913.
Rhizomolgula globularis.

Station 22. Southwest of Point Lay, Alaska, (69° 35′ N. lat., 163° 27′ W. long.), 11-12 fathoms, rock and sand, August 17, 1913.
Chelyosoma macleayanum.

Station 23. Northeast of Icy cape, Alaska, (70° 24′ N. lat., 161° 25′ W. long.), 9-10 fathoms, mud and pebbles, August 19, 1913.
Trididemnum tenerum.
Didemnum albidum (?)
Chelyosoma macleayanum.
Cystingia griffithsii.
Goniocarpa lovenii.
Goniocarpa rustica.
Boltenia echinata.

Station 27 *d*. Bay at Collinson point, Alaska, 0-1 fathom, gravel and tundra debris, September 15, 1913.
Rhizomolgula globularis.

Station 27 *s*. Camden bay, Collinson point, Alaska, 3 fathoms, sandy mud and gravel, October 3, 1913.
Rhizomolgula globularis.

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Station 37 *b*. Inner harbour at Bernard harbour, Dolphin and Union strait, Northwest Territories, 2-3 fathoms, sandy mud, August 25, 1914.
Cystingia griffithsii.

Station 37 *c*. Inner harbour at Bernard harbour, Dolphin and Union strait, Northwest Territories, about 2 fathoms, sandy mud, September 1, 1914.
Rhizomolgula globularis.

Station 41. Outer harbour at Bernard harbour, Dolphin and Union strait, Northwest Territories, about 10 metres, sandy mud, July 20, 1915.
Ascidiopsis prunum.
Cystingia griffithsii.
Rhizomolgula globularis.

Station 43 *a*. Dolphin and Union strait, Northwest Territories, about 100 metres, sandy with pebbles, September 13, 1915.
Cystingia griffithsii.

Station 43 *b*. Dolphin and Union strait, Northwest Territories, 50-60 metres, sandy mud with pebbles, September 14, 1915.
Cnemidocarpa rhizopus.

Station 43 *c*. Dolphin and Union strait, Northwest Territories, 20-30 metres, gray mud and stones, September 14, 1915.
Styelopsis sp. (?).

Station 50 *d*. Young point, Dolphin and Union strait, Northwest Territories, 0-1 fathom, rock, July 21, 1916.
Styelopsis sp. (?)

Aplidium spitzbergense Hartmeyer

1903. *Aplidium spitzbergense*, HARTMEYER, p. 341.

1908 *b*. *Amaroucium sarsi*, BJERKAN, p. 92.

1912. *Aplidium spitzbergense*, HUNTSMAN, p. 137.

West coast of McClintock island, Franz Josef land, (80° 22′ N. lat.), July 1902, Baldwin-Ziegler expedition, U. S. Nat. Mus. No. 6640, 2 colonies.

In the smaller colony (20 × 15 × 8 mm.) the zooids are at most 5·7 mm. long, and no eggs or embryos could be found. In the larger one (28 × 20 × 10 mm.) the zooids were as long as 10 mm., and both eggs and embryos were observed. The difference in the length of the zooids appears to be due wholly to the postabdomen, the abdomen and thorax being virtually of the same length in individuals from both colonies.

There are four rows of stigmata with about twelve stigmata in each row, three dorsal languets, and three gastric folds. The languet in front of the atrial aperture varies much in length and may be either simple or forked.

There seems to be no essential difference between Bjerkan's species, which he places in the genus *Amaroucium*, and that described by Hartmeyer. The differences hitherto given as a basis for separating the two genera are not sufficient for dividing the species distinctly into two natural groups, and revision is much needed.

The distribution of this species is similar to that of a number of other Ascidians and may be defined as being nearly throughout the Atlantic arctic and subarctic regions.

Tridemnum tenerum (Verrill)

1896. *Didemnoides variable.* Huitfeldt-Kaas, p. 5.
See Van Name (1910, p. 385) for description and literature.
Station 23, one colony.

No spicules were found in the single colony obtained. Colony 34 × 18 × 7 mm.; individuals about 1·5 mm. long; oral aperture 6-lobed; the atrial without languet on a tubular siphon and indistinctly lobed; three rows of stigmata, about 12 in each row; two dorsal languets on transverse vessels of left side; testis with coiled vas deferens on outer surface.

This is an arctic species, which is doubtless circumpolar, the present record tending to connect the known distribution in northern European seas and the Asian arctic ocean with that along the east coast of America from Newfoundland to Cape Cod.

Didemnum albidum (Verrill) (?)

See Van Name (1910, p. 378 as *Tetradidemnum albidum*) for description and literature.
Sta. 23, 3 colonies.

The very small size of the colonies in the collection has prevented a positive identification. In the character of the spicules and in such details of the structure of the zooids as could be determined they agree with the description of this species given by Nan Name.

This is a very definite extension of the known distribution of this species, which hitherto has been found only in the Atlantic portion of the arctic and subarctic from Spitsbergen and the Murman coast to Davis strait and Cape Cod. Hartmeyer has, however, recently (1921, p. 87) reported it from the Siberian arctic coast and Bering strait.

Ascidiopsis prunum (O. F. Müller)

See Van Name (1912, p. 599 as *Phallusia prunum*) for description and literature.
Sta. 41, 4 specimens.—North Greenland, coll. P. H. Sörensen, U.S. Nat. Mus. No. 6632, 1 specimen.

This is a widely distributed circumpolar form. As Hartmeyer has surmised, it occurs in the northern Pacific, and I expect to publish shortly an account of its synonymy and distribution there.

Ascidiopsis dijmphniana (Traustedt)

1886 *Phallusia dijmphniana*, Traustedt, p. 424.
1903. *Ascidia dijmphniana*, Hartmeyer, p. 293.

Aberdare channel, east of Alger island, Franz Josef land, June, 1901, Baldwin-Ziegler expedition, U. S. Nat. Mus. No. 6639, 1 specimen.

As this species has not been very thoroughly described, an account of this well preserved specimen from Franz Josef land is desirable.

In size, 34 × 24 × 14 mm. The animal is oblong in shape and is attached by the posterior part of the left side. The surface is extensively wrinkled and shows scattered, minute papillæ 0·1 mm. in diameter, and from 0·1 to 0·3 mm. long, in which terminate many of the vessels which are abundant throughout the test. These papillae are best developed and most numerous near the apertures, but are present over the entire unattached portion of the test. The apertures are both at the anterior end, the oral in the centre and the atrial at the dorsal angle. The lobes are provided with many scattered, short papillae, and number seven for the oral and six for the atrial.

Test from 0·3 to 1 mm. thick, pliable, translucent and vascular throughout. The main vessel enters the test on the left side near the postero-ventral angle of the body. The principal branches take almost parallel courses toward the anterior end, except that a large vessel proceeds along the left side dorsally, passes between the siphons, and, turning backward on the right side, breaks up into four parallel branches and supplies nearly the whole of the antero-ventral half of the test on that side.

The tentacles number 66 and the prestigmatic zone is smooth. The dorsal tubercle is in the form of a simple horseshoe, with the broad opening between the horns directed forwards. The anterior lip of the peripharyngeal groove is very broad near the tubercle, and partly covers the latter. The dorsal ganglion is close to the tubercle.

The dorsal lamina is ribbed on both sides as far as the oesophageal area, but only on the left side farther back. Its margin is coarsely toothed or laciniate, the teeth corresponding to the ribs of the left side. There are occasional intermediate teeth. The lamina extends a considerable distance behind the oesophageal aperture. The accessory lamina on the right side of the oesophageal area is ribbed on the right side and has teeth corresponding with the ribs. The pharynx extends about 7 mm. behind the oesophageal aperture.

There are 60 longitudinal bars on the right side, and 55 on the left. There are small papillae at the junctions of bars and transverse vessels, and also intermediate papillæ in most parts of the pharyngeal wall. There are about two longitudinal bars for each plication of the wall. The stigmata are three to six in number for each mesh.

The intestinal canal occupies nearly two-thirds of the left side of the body from the posterior end forwards, and is much obscured by the rather thick coating of closely placed renal vesicles. The stomach is short, broad, transversely placed, and apparently with seven folds on the right side. The intestine takes a rather evenly curved S-shaped course to end at the base of the atrial siphon in the anus, which exhibits a bilobed reflexed margin.

The complexly branched ovary is situated in the first intestinal loop and extensively covers the right side of the first limb of the intestine, but extends only slightly over the left side of the latter. Testes were not seen. The oviduct crosses the last bend of the intestine, and then accompanies the rectum along its dorsal side.

Hartmeyer (1919, p. 131) has expressed a doubt as to the distinctness of this species from *A. prunum*, and believes individuals of the latter species which he has seen show intermediate conditions which connect the two. To the characters which have been given by Hartmeyer (1903, p. 293) for distinguishing the two species, I would add two, namely the presence of minute papillae scattered generally over the surface of the test in *A. dijmphniana* and their absence in *A. prunum*, and the number of longitudinal bars (15 to 20 on each side in the latter, and more than 50 in the former). Although the two species may tend to intergrade in other characters, it is suggested that in these two respects they may always be distinguished.

This record extends only slightly the known distribution of this species, which has been found in the arctic seas to the north of Russia. However, material collected by Dr. E. M. Kindle on the Labrador coast in 1921 contained a single specimen of this species, whose distribution is doubtless fairly extensive in the Atlantic portion of the arctic and sub-arctic regions.

Chelyosoma macleayanum Brod. and Sow.

See HARTMEYER (1903, p. 269) and VAN NAME (1912, p. 591) for description and literature.

Station 22, 2 specimens.—Station 23, 11 specimens.

This well known species is a characteristic arctic circumpolar form, but is usually found in very small numbers. The specimens here reported show the usual large size that is attained by this species in the arctic, as compared with the subarctic. All but two of the specimens were from 16 to 37 mm. long. Their growth has been studied (Huntsman, 1921).

Molgula septentrionalis Traustedt

For literature references on this species see VAN NAME, 1912, p. 478, and Redikorzew, 1916, p. 94.

Aberdare channel, east of Alger island, Franz Josef land, June 1901, Baldwin-Ziegler expedition, U.S. Nat. Mus. No. 6639, 1 specimen.

This species has previously been recorded from Spitsbergen, as well as from other points in the Atlantic portion of the arctic from Novaya Zemlya (Redikorzew, 1916, p. 94) to Hudson bay (Huntsman, 1922).

Cystingia griffithsii MacLeay

1825. *Cystingia griffithsii*, MACLEAY, p. 541.
1842. *Clavelina chrystallina*, MÖLLER, p. 95.
Pera, Molgula, s. Caesira crystallina, auct. var.

Station 23, 5 specimens.—Station 37 b, 14 specimens.—Station 41, 4 specimens.—Station 43 a, 1 specimen (test only).

In 1825 MacLeay described three species of Ascidians that had been collected by W. N. Griffiths at Winter island in Fox channel on Capt. Parry's second arctic voyage. Two of these are well known arctic forms (*Boltenia* and *Dendrodoa*). The third, which he called *Cystingia griffithsii*, has not since been recognized among arctic or other material of Ascidians. It has been considered as belonging to the family *Tethyidae* (*Cynthiidae*), and to be near the genus *Fungulus*. Hartmeyer has, however, (1903, p. 188) called attention to the fact that an organ of this species described and figured by MacLeay resembles the renal organ of Caesirids (Molgulids). As this form was obtained in the same general region as that explored by the Canadian Arctic Expedition, it seemed probable that *Cystingia* might be found in the material brought back by that Expedition. After working over that material, I turned to MacLeay's figures and description of *Cystingia*, and it was at once apparent that MacLeay's *Cystingia griffithsii* was none other than a somewhat unusual specimen of the now well known *Caesira* (*Molgula*) *crystallina*, first described by Möller in 1842 from Greenland.

MacLeay's description and figures were not sufficiently clear and accurate to have prevented error concerning the systematic position of this species. The unusual structure of the stalk of his single specimen has perhaps contributed to the failure in the identification of his species with *C. crystallina*. One of the specimens collected by Johansen has a similar stalk, with the attached area and "roots" along one side instead of being, as is usual, at the distal end. Individuals with intermediate conditions were also brought back by Johansen.

Of the characters given by MacLeay, the following show the Caesirid nature of his species. Semi-pellucid test, with viscera showing through; muscles only (?) near apertures, and crossing at right angles and not obliquely, as in *Boltenia* for example; branchial meshes irregular (as compared with *Boltenia* and *Dendrodoa*); a renal organ—"diaphanous longitudinal pouch" containing "two blackish nodules"—present and on right side; and left gonad above intestinal loop. Two characters given by MacLeay do not agree with those of Caesirids. These are the 4-lobed oral aperture and the absence of a liver. In this species the oral aperture has three lobes on each side, and of these the posterior is the most prominent, after that the anterior, while the middle one is relatively small. In a certain state of contraction, the middle lobe is distinguished with difficulty, and the four atrial lobes are at the same time equally indistinct. This is sufficient to explain MacLeay's description of the "branchial orifice" as quadrified and the "anal orifice" "apparently without rays." While MacLeay states that his species "has no liver very distinct," the structure that he described and figures as the heart is doubtless the liver. The latter is well depicted (although not named) in position, form, and shade, in his figure 4.

In favour of the identification of MacLeay's species with *C. crystallina*, we have the general shape, the size, the character of the surface, the presence and character of the stalk, and the positions of the two apertures. Also the two vascular processes (one is broken) which pass into the stalk, are represented in his figure 4. He states, however, that "the branchial pouch has about fourteen folds," whereas *C. crystallina* has been described as having only ten. The condition of MacLeay's specimen apparently did not permit of accurate determination of the number. Nevertheless, in support of MacLeay's view as to the indefiniteness of the number, we have in this species what appears to have been overlooked, namely that there are in reality more than ten folds. In fact there are fourteen rows of infundibula, and therefore fourteen folds. The most dorsal and most ventral of the left side entirely lack longitudinal bars, which renders them insignificant in comparison with the others, which possess from three to four. On the right side the most ventral is without bar and the most dorsal with one only. The formula of one specimen is:—

Left. Dors. 0 (0) 0 (4) 0 (4) 0 (4) 0 (3) 0 (3) 0 (0) 0 Vent.

Right. Dors. 0 (1) 0 (4) 0 (4) 0 (4) 0 (4) 0 (3) 0 (0) 0 Vent.

Another point worth noting is that MacLeay refers to the branchial folds being transverse in position rather than longitudinal, and this is indeed their position.

In view of these facts there can be no reasonable doubt as to the identity of MacLeay's species. The name he has given must, therefore, replace Möller's name *chrystallina*.

The position of the testes in this species deserves consideration. Both Van Name (1912, p. 495) and Oka (1914, p. 444) figure them as grouped along the anterior half or two-thirds of the ovary. The latter also describes a new species (*Molgula redikorzevi*) similar to this one, except that the testes are separated from the ovaries and lie, those of the right side below the renal organ, and those of the left side in the intestinal loop, as in *M. fortiformis*. Redikorzew (1916) figures the testes in *crystallina* (p. 62) at the anterior end of each ovary, and in *redikorzevi* (p. 67) on the right side from the anterior end of the ovary around the anterior end of the renal organ and below it, and on the left side in, below, and on the inner side of the intestinal loop. I have found that in one large and nine small specimens from Bernard harbour, the testes are almost invariably at or near the anterior end of the ovary, but tend to extend down in front of the renal organ on the right and the intestinal loop on the left. In one specimen on the left side they are on the outer side of the oviduct, that is at

the posterior end of the ovary, while on the right side they are at the anterior end. In four large specimens from the Gulf of St. Lawrence and the Bay of Fundy the position of the testes varies, but in no specimen have I yet found them alongside the ovary or near its posterior end. They are at the anterior end of the ovary or distributed more or less around and under the renal organ on the right side, and into or below the intestinal loop on the left, the extreme condition being similar to the condition figured by Redikorzew for *redikorzevi*. Whether this latter condition is more typical of individuals from more southern waters, as the facts seem to indicate, is a question deserving investigation. It is, however, at least doubtful whether *redikorzevi* is to be considered distinct from *griffithsii* (*crystallina*). In any event the testes in the latter species are to be considered as varying in position and as perhaps normally being more or less separated from the ovary.

MacLeay's genus *Cystingia* antedates the *Molgula* of Forbes. It need not replace the latter, seeing that the form on which it was based is one of a natural group of species including *redikorzevi* and *retortiformis*, that should be separated from the genus *Molgula* as formerly defined (see Huntsman, 1922).

Rhizomolgula globularis (Pallas)

For description and literature references on this species see Huntsman, 1913, p. 137, and Redikorzew, 1916, p. 128.

Station 20 b-c, 4 specimens.—Station 20 d, 2 specimens.—Station 21 d, e and g, 1 specimen.—Station 27 d, 32 specimens.—Station 27 s, 1 specimen. Station 37 e, 24 specimens.—Station 41, 1 specimen.

Redikorzew (1916, p. 128) has considered *R. arenaria* Ritter, *R. ritteri* Hartmeyer, *R. intermedia* Michaelsen, *R. warpachorskii* Redikorzew, and *R. gigantea* Redikorzew, to be synonymous with Pallas' species, and there appears, indeed, to be no sufficient reasons for considering any of them to be distinct, the differences noted being no greater than might be due to age and individual variation.

Material at my disposal comes from Labrador, Hudson bay, James bay, Bernard harbour (Dolphin and Union strait), Collinson point, Cape Lisburne, Grantley harbour, and Bristol bay, the latter four places being in Alaska and at widely separated points from north to south. The material from Bristol bay (*Albatross* sta. 3229) has been identified by Ritter (1913, p. 444) as *R. ritteri*. Of the characters that have been given as distinguishing species in this genus, none seems to be sufficiently definite and invariable to base divisions upon. The amount of sand covering the surface depends upon the nature of the bottom, in some places being entirely absent. The shape varies considerably depending to some extent upon age and state of contraction. The elongation may be parallel or at right angles to a line from the attached to the free end. There may or may not be lateral flattening. The "root" for attachment may be simple and small or much-branched and extensive. The musculature is perhaps relatively more powerful in large individuals and appears heavier in contracted specimens. Its arrangement I have already described (Huntsman, 1913, p. 137). The tentacles vary in number and size. The dorsal tubercle has the aperture between the horns directed from directly anterior to almost directly to the left. The pharyngeal folds are more or less prominent, depending upon the state of contraction and the method of preservation. The number of bars on each longitudinal fold is no more variable than is usual in Caesirids, and the small differences claimed as important cannot be considered significant.

We have, therefore, as yet but one species of the genus; and it is a very characteristic form of shallow water of rather low salinity in the arctic. It is entirely circumpolar, having been reported from the White sea and Novaya Zemlya (Redikorzew, 1916), Franz Josef land (Hartmeyer, 1911), New Siberian islands, several points along arctic coast of Siberia and Okhotsk sea (Redikorzew, 1916), both southern and northern Alaska (Ritter, 1901, and listed above), Canadian arctic coast at Herschel island (Huntsman, 1913), and Bernard harbour (listed above), James bay, (Huntsman, 1922), Baffin bay (Hartmeyer, 1903) and north east Greenland (Hartmeyer, 1910). In addition I have examined material of this species collected by E. M. Kindle in Hamilton inlet, on the coast of Labrador in 1921.

Johansen has made the following notes regarding the occurrence of this species at Collinson point, Alaska (Station 27 d): "A part of the shore is formed by the tundra, and the gravel on the beach and in the adjoining shallow water is covered by a thick layer of tundra débris. This particular part of the littoral region, in depth from one-half to about three feet, seems to be a veritable 'hot-bed' for a ball-shaped Ascidian, which has its roots attached to the débris or among the gravel, but which I did not find in the littoral region outside this particular bottom. Dead, shrunken individuals of the same species were common washed up on the beach up to high-water mark, and had probably been torn loose by the waves."

Kükenthalia borealis (Gottschaldt)

1903. Hartmeyer, p. 260.
1921. Arnbäck-Christie-Linde.

West coast of McClintock island, Franz Josef land, (80° 22′ N. lat.), July 1902, Baldwin-Ziegler expedition, U. S. Nat. Mus. no. 6640, 1 colony.

This species has hitherto been known from Davis strait, Iceland, Norway, Murman coast, Bear island, and Spitsbergen.

Styelopsis sp. (?)

Station 43 c, 1 specimen.—Station 50 d, 1 specimen.

The two specimens are approximately 2 mm. long and 1 mm. high. As they are immature and their structure cannot be fully determined, it would seem unwise to name them specifically, even though they seem to differ from any described form.

In the first specimen the surface is covered with scattered sand grains. The apertures are at either end of the free surface on short siphons and seem both to be 4-lobed. The test is thick and translucent. The musculature is well developed and consists of the two usual layers. The oral tentacles are simple and short. The dorsal lamina is toothed. There are five longitudinal bars on each side. No atrial tentacles have been found. The stomach is horizontally placed on the left side, and the intestine turns to run parallel to it, finally ascending to end in the anus near the atrial aperture. There is a single gonad on the right side, which is vertically (dorso-ventrally) oriented and close to the anterior end. It consists of a central ovary and several testes along the margin.

In the second specimen the surface is wrinkled and not sand covered. No lobes could be discerned for the apertures. The test is thin and somewhat opaque. There are 4 or 5 dorsal languets. There are 6 longitudinal bars on the right side of the pharynx and 5 on the left. About 20 stigmata on each side of pharynx extending dorso-ventrally, the anterior ones breaking up into smaller stigmata, but none of the latter elongated antero-posteriorly. About 6 gastric folds. Anus with smooth margin.

The transverse stigmata, absence of pharyngeal folds, and presence of dorsal languets or teeth on the dorsal lamina, are believed to be merely juvenile characteristics.

The arrangement of the parts of the gonad is similar to that in *S. uniplicata* (Bonnevie, 1896, p. 7).

Dendrodoa adolphi (Kupffer)

See Ritter (1913, p. 484) and Redikorzew (1916, p. 297) for description and literature.

West coast of McClintock island, Franz Josef land, (80° 22′ N. lat.), July, 1902, Baldwin-Ziegler expedition, U.S. Nat. Mus. no. 6640, 6 specimens.

The invariability in the number (3) of branches of the gonad is perhaps the most striking character of this species. The strong development of the pharyngeal folds and the large number of tentacles (about 55) are also important.

The three specimens dissected showed the following characters. The lengths were 9, 12 and 15 mm., and the diameters 6, 9, and 10 mm. As the specimens were considerably contracted, the shape in extension must be quite long and cylindrical. The roughening of the surface appears to be almost entirely due to contraction, although there may be several irregularly placed and irregularly shaped excrescences. The area of attachment is definitely terminal and small. 50 tentacles were counted in the second specimen. The majority were approximately equal in size, but a few were quite small. Aperture of dorsal tubercle crescent-shaped. Opening between horns directed forwards, and slightly toward left.

Formula for bars on pharyngeal folds.

1. Right.	Dors.	0 (8) 1 (4) 1 (6) 1 (4) 1	Vent.
2. Right.	"	1 (12) 0 (6) 0 (9) 0 (7) 0	"
Left.	"	1 (12) 0 (5) 0 (8) 0 (6) 0	"
3. Right.	"	1 (9) 1 (4) 1 (8) 1 (5) 1	"
Left.	"	1 (9) 1 (4) 1 (7) 1 (5) 1	"

Gastric folds from 24 to 30 in number. Intestine varying much in curvature. In the first specimen it bends back to run parallel to and close beside the stomach and continues in an almost straight but short course to the anus. In the third specimen it takes a short S-shaped course, the final part paralleling the oesophagus and continued into a very long rectum. In the second specimen only does the condition correspond with that described by Ritter, that is with the first part making an even curve around to the oesophagus, and then bending rather sharply forwards and downwards.

The necessity for a revision of the species of this genus has been repeatedly emphasized. No one seems yet to have had sufficient material for this purpose. Although I have referred these specimens to Kupffer's species, it is highly probable that the latter is identical with *D. kükenthali* Hartmeyer (1899, p. 493) and *Cynthia pulchella* Verrill (1871, p. 98). The latter has been well described by Van Name (1912, p. 581) as *D. aggregata* var. *pulchella*. If these species are synonymous, Verrill's name will have the priority. The differences that have been noted between these forms do not seem to be very important, having to do with the numbers and sizes of the tentacles, numbers of longitudinal bars, orientation of dorsal tubercle, number of gastric folds, and course of intestine, all of which vary greatly from individual to individual. With such limited material at my disposal, I hesitate to unite these forms.

D. adolphi has been recorded from north-east Greenland, Bering sea, and the Gulf of Tartary; *D. kükenthali* from Bering sea, Siberian Arctic ocean, Kara sea, and Spitsbergen; and *D. pulchella* from Newfoundland to the Gulf of Maine.

Cnemidocarpa rhizopus (Redikorzew)

See Redikorzew, (1908, p. 32 as *Styela rhizopus*, and 1916, p. 271) and Huntsman (1922) for description and literature.

Station 43 b, 4 specimens.

The four specimens in the collection are all very small, being only from 3 to 3·5 mm. in diameter. Each possesses a single long, much-branched root, which is as much as 5 mm. long. In shape they are approximately spherical and their surface is entirely covered with sand grains. They correspond in external characters with small specimens of this species obtained in Hudson bay.

In the single specimen dissected the following characters were determined.

Musculature much reduced, scarcely extending beyond siphons.

Tentacles short and about 24 in number. Formula for pharyngeal folds

Right, Dors. 0 (4) 0 (1) 0 (3) 0 (1) 0
Left. " 0 (3) 0 (1) 0 (3) 0 (1) 0

Dorsal lamina with smooth undulatory margin. Stomach short, with about 12 folds. Anus with about 10 somewhat reflexed rounded lobes. Gonads oval, oblong, or almost globular in shape, directed towards atrium, three on the right side and two on the left.

The small numbers of tentacles, longitudinal bars, or pharyngeal folds, gastric folds, and anal lobes, as compared with previous accounts for the species, may be referred to the small size of the individual. In the number of the gonads there is agreement with Hudson bay specimens (Huntsman, 1922).

The records of this species, though few, indicate a circumpolar distribution with little extension into the subarctic. The species has been known from the Siberian arctic coast, Novaya Zemlya, the Murman coast, north-east Greenland, and Hudson bay.

Goniocarpa lovenii (Kor. et Dan.)

See Van Name (1912, p. 560 as *Tethyum coriaceum*) and Redikorzew (1916, p. 244, as *Goniocarpa coriacea*) for description and literature.

Station 23, 4 specimens.—Cape Lisburne, Alaska, 5-10 fathoms, sand and gravel, coll. W. H. Dall, U. S. Nat. Mus. No. 6647, 1 specimen.

Elsewhere (Huntsman, 1922) I have expressed an opinion on the distinctness of certain of the forms that have been united with this species by Redikorzew (1916) and Hartmeyer (1915). They are indeed nearly related and the majority have not yet been clearly shown to be distinct. There is certainly very considerable individual variation in both external and internal characters. The arctic specimens listed above do not differ essentially, so far as examined, from specimens taken along the Canadian Atlantic and Pacific coasts, for which I have used the names *G. placenta* and *G. coccodes* respectively. The specific name of *lovenii*, given by Koren and Danielssen I use as being the proper one for this species on the authority of Hartmeyer (1915, p. 326 as *Styela lovenii*).

This species is circumpolar and extends in distribution well into the subarctic on all coasts.

Goniocarpa rustica (L.)

See Van Name (1912, p. 549 as *Tethyum rusticum*) and Redikorzew (1916, p. 229) for description and literature.

Station 23, 4 specimens.—Beach at Winter harbour, Melville island, 1909, coll. F. Hennessey, Canadian Fisheries Museum, 1 specimen (test only). - West coast of McClintock island, Franz Josef land, (80° 22′ N. lat.), July, 1902, Baldwin-Ziegler expedition, U. S. Nat. Mus., No. 6640, 2 specimens. Aberdare channel, east of Alger island, Franz Josef land, June, 1901, Baldwin-Ziegler expedition, U. S. Nat. Mus. No. 6639, 2 specimens.

This species occurs throughout the arctic, and its distribution extends into the subarctic in the north-western Pacific and on both sides of the Atlantic. The present records assist in demonstrating its circumpolarity, being the first for the region between Bering sea and Jones sound off Baffin bay (Bjerkan, 1908 a, p. 6).

Boltenia echinata (L.)

See Van Name (1912, p. 523 as *Pyura echinata*), Huntsman (1913, p. 163, as *B. arctica*) and Redikorzew (1916, p. 151) for description and literature.

Station 23, 10 specimens.—South gate, northwestern Spitsbergen, (79° 40′ N. lat.), 7 fathoms, coll. E. Wilkinson, U. S. Nat. Mus. No. 5971, 1 specimen.

These arctic specimens exhibit the characteristic spines (elongated axis and definite whorl of short branches) of the more northern form of this widely distributed species, and differ, therefore, from the subarctic form, which has shorter, irregularly branched spines.

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